

No-Dig Live 2010 Breakfast Briefing

Carbon footprinting of pipeline installation and rehabilitation techniques



CP364 Project objectives



- to develop an embodied carbon measure and associated carbon accounting protocol relating to the greenhouse gas (GHG) emissions
- for pipe and lining materials and their installation
- methodology will comply with guidance from Ofwat and Defra

CP364 Project background



- Carbon accounting/footprinting
- “Level playing field”
- Benefits of project include:
 - quantitative information on GHG emissions
 - developing a common measure and protocol to quantify the carbon footprint of products
 - providing independent demonstration of carbon footprint

CP364 participants



- Bournemouth and West Hampshire Water
- Insituform Technologies Limited
- National Grid
- Onsite
- Prokasro Mechatronik GmbH
- Severn Trent Water

'Carbon Accounting'



Good soundbite – but ...

- CO₂ not always the only GHG of concern
- CH₄ more powerful than CO₂ - GWP 21
- N₂O ('the forgotten GHG') even worse - GWP 310
- HFCs Hydrofluorocarbons – GWP 140 - 11,700
- PFCs Perfluorocarbons – GWP 6,500 – 9,200
- SF₆ Sulphur Hexafluoride – GWP 23,900

Emission factor

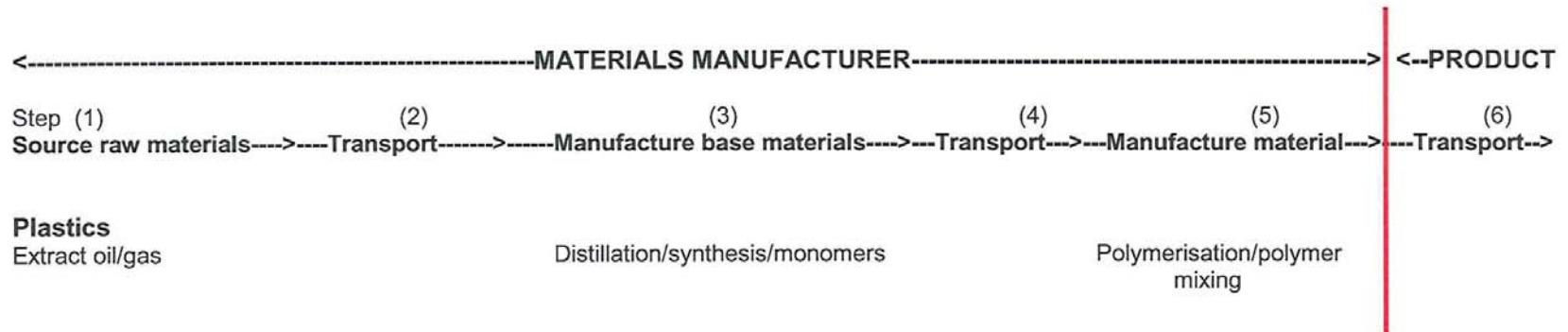


- Emission factor defined as “a factor that converts a quantity of material/activity to the corresponding, estimated emission value”
- Example: 1kg of HDPE pipe at the factory gate creates 2kg of CO₂ emissions (Source: ICE, 2008)
- Need to define boundaries:
 - Cradle to gate
 - Cradle to site

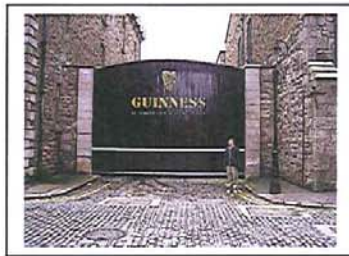
Source of material



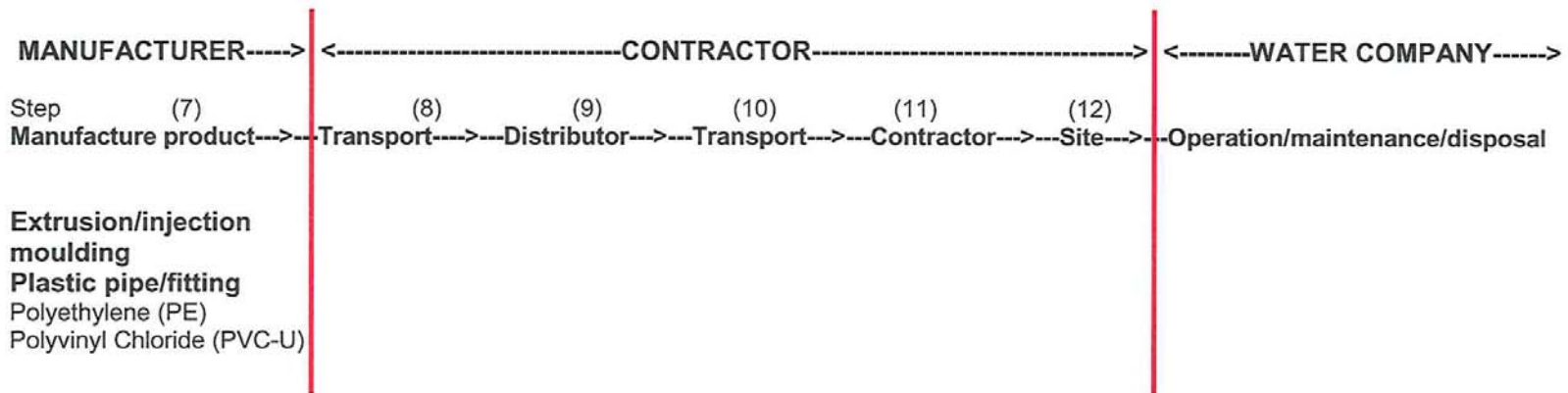
Cradle to manufactured material

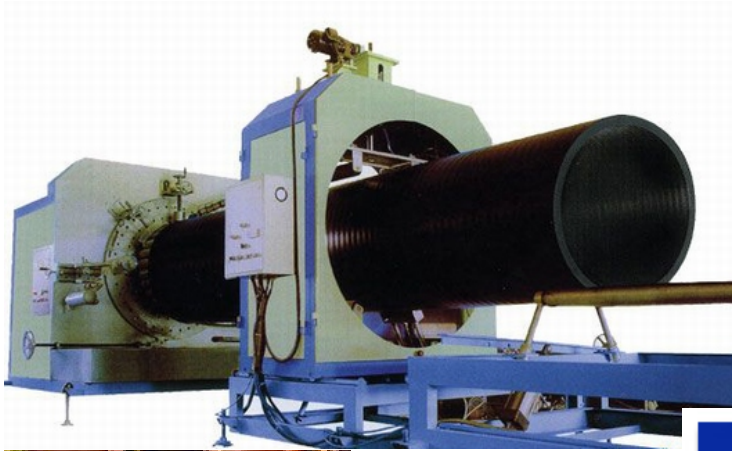


Source of product



Factory gate to site







Other emission factors



Public domain values for:

- Transport, type of vehicle/fuel (Defra 2009)
 - CO₂ and CO₂e
- Fuel emissions, type of fuel
- UK grid electricity use (GHG Inventory 2009)

Default values included in tool



- Average asphalt thickness
- Compaction equipment options
- Excavation equipment options
- Jetting equipment options
- 5% 'up-lift' to account for items

Technique templates available (1)

- Conventional trenching
- Directional drilling
- Impact moling
- Microtunnelling/Pipe ramming
- Pipe bursting
- Lining with close-fit pipes
- Lining with continuous pipes

Technique templates available (2)

- Lining with cured-in-place pipes
- Lining with discrete or segmental pipes
- Lining with spirally wound pipes
- Lining with sprayed material
- Repair with cured-in-place patch
- Repair with injection grouting by robotic means
- Repair using lateral connection collar

Microsoft Excel - Example.xls

File Edit View Insert Format Tools Data Window CPIPE Help

Type a question for help

120%

Arial 10

Reply with Changes... End Review...

Phase	Activity	Element	Phase Title	Activity Title	Element Type	Comments	kgCO2	kgCO2eq
1			Materials					
	1							
		1			Materials - Primary	Lining material 1	41	41
		2			Van, Lorry Transport	Distance from manufacture to distributor	180	182
		3			Van, Lorry Transport	Distance from distributor to contractor depo	66	67
		4			Van, Lorry Transport	Distance from depot to site	22	22
		5			Materials - Primary	Lining material 2	2567	2567
2			Installation					
	1			Install pipe				
		1			Car Transport	Installation crew to/from site	15	15
		2			Van, Lorry Transport	Equipment for lining operation to/from site	75	76
		3			Generators	Traffic management (provision of traffic light	11	11
		4			Van, Lorry Transport	Sewage flow (tankering)	28	28
		5			Motor-driven machinery	Pipe cleaning	1	1
		6			Van, Lorry Transport	Disposal of jetting water/silt/etc.	28	28
		7			Generators	CCTV survey	4	4
		8			Manual (No emissions)	Set-up installation equipment	0	0
		9			Water	Water for curing plus treatment	7	7
		10			Generators	Curing of lining	88	89
		11			Generators	Reconnection of services/laterals	4	4
		12			Van, Lorry Transport	Tankering curing water away	25	26
		13			Van, Lorry Transport	Disposal waste (transport to disposal site -	5	5

Project Definition Report Car Transport Van, Lorry Transport Rail,Sea,Air Freight Materials - Primary Materials - Reinstatement Water Motor-d

Microsoft Excel - Example.xls

File Edit View Insert Format Tools Data Window Cope Help

Type a question for help

90%

Arial 10

Reply with Changes... End Review...

B16 =C16&"&D16&"&E16

ID	Calculations		Comments	Material Type		Quantity							Emission factors				Emissions	
	Element	Sub-element		Calcs	Goto	Category	Material	Direct quantity, kg	External diameter, mm	Wall thickness, mm	Volume fraction, %	Length, m	Density, kg/m ³	Derived quantity, kg	Factor, CO ₂ , kg/kg	Factor, CO ₂ eq, kg/kg	kgCO ₂	kgCO ₂ eq
1.1.1	1	No	Lining material 1	Liner	PE sleeve liner		300	5	25	100	175	20	2	Default	2	Default	41	41
1.1.2	1	No	Lining material 2	Resin	Epoxy resin		300	5	75	100	1250	434	5.91	Default	5.91	Default	2567	2567

1	Append Sub Element		Append
2	Delete Sub Element		Delete
3	Go to Project Definition		Proj Def

	Calculations		Comments	Output		Utilisation			Fuel			Emission factors			Emissions			
	Element	Sub-element		Max kW	Mean load, %	Time on site, d	Utilisation, h/d	Count	Type	Combustion energy, MJ/l	Consumption, l	Factor, CO2, kg/l	Factor, CO2ec, kg/l	kgCO2	kgCO2eq			
16	2.1.3	1	N:	Traffic management (provision of t	1.5	100	1	8	1	Diesel	36.1	40	2.6391	Default	2.6694	Default	11	11
17	2.1.7	1	N:	CCTV survey	5	100	1	1	1	Diesel	36.1	17	2.6391	Default	2.6694	Default	4	4
18	2.1.11	1	N:	Curing of lining	25	100	1	4	1	Diesel	36.1	332	2.6391	Default	2.6694	Default	86	89
19	2.1.12	1	N:	Reconnection of services/laterals	5	100	1	1	1	Diesel	36.1	17	2.6391	Default	2.6694	Default	4	4

Sewer renovation Case study (1)



- Renovation of a 60m length of 300mm diameter sewer between two manholes
- Under minor road (urban terrace housing)
- Ten laterals either side
- 3m cover depth
- Groundwater at surface
- 5% vertical deformation

Sewer renovation Case study (2)



- Project emissions:
 - Conventional trenching is 16,382 kgCO₂
 - Pipe bursting is 5,109 kgCO₂
 - Lining with close-fit pipes is 4,368 kgCO₂
 - Lining with cured-in-place pipes is 3,044 kgCO₂

Water main installation

Case study (1)



- Installation of a 75m length of 160mm OD HDPE pipe
- Under minor road (urban terrace housing)
- Twelve connections either side
- 0.9m cover depth
- Maximum distribution pressure 6 bar (specified 10 bar pipe)

Water main installation Case study (2)



- Project emissions:
 - Conventional trenching is 11,079 kgCO₂
 - Directional drilling is 3,429 kgCO₂

Future developments?



- Incorporating emissions from stationary vehicles

